

Denoising Diffusion Restoration Models

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Abstract

Many interesting tasks in image restoration can be cast as linear inverse problems. A recent family of approaches for solving these problems uses stochastic algorithms that sample from the posterior distribution of natural images given the measurements. However, efficient solutions often require problem-specific supervised training to model the posterior, whereas unsupervised methods that are not problem-specific typically rely on inefficient iterative methods. This work addresses these issues by introducing Denoising Diffusion Restoration Models (DDRM), an efficient, unsupervised posterior sampling method. Motivated by variational inference, DDRM takes advantage of a pre-trained denoising diffusion generative model for solving any linear inverse problem. We demonstrate DDRM's versatility on several image datasets for super-resolution, deblurring, inpainting, and colorization under various amounts of measurement noise. DDRM outperforms the current leading unsupervised methods on the diverse ImageNet dataset in reconstruction quality, perceptual quality, and runtime, being 5x faster than the nearest competitor. DDRM also generalizes well for natural images out of the distribution of the observed ImageNet training set.